Benefits of Chess

by Bill Wall

Chess is good for you. Chess is an exercise of infinite possibilities for the mind, and a new form of thinking. Chess is a fairly easy game to learn, just difficult to master. Chess provides immediate feedback and offers immediate rewards and punishments for problem solving. Chess assists in memory improvement, logic, observation and analysis, and operant conditioning. Chess develops intellectual, esthetic, sporting, decision making, concentration, personal responsibility, and perseverance skills. The game of chess helps improve recall, analysis, judgment, and abstract reasoning. Chess helps you develop mental abilities used throughout life: concentration, critical thinking, abstract reasoning, problem solving, pattern recognition, strategic planning, creativity, analysis, synthesis, and evaluation.

Perhaps the top 10 benefits of chess are:

1. It brings people together
2. It teaches us how to win and lose.
3. It helps children realize the consequences of their actions
4. It can help you focus
5. It can be used as an educational tool
6. It helps develop creativity.
7. It builds confidence
8. It develops problem-solving skills
9. It exercise the brain
10. It helps you to remain calm under pressure (source: "Top 10 Benefits of Chess, *Chess.com*, March 17, 2022)

In 1893, Alfred Binet investigated the link between mathematics and chess. He found that over 90% of leading chess players were good at doing mental calculations and also had good memories.

In 1977, Adrian De Groot suggested that there were two types of benefit to young people learning chess. First, there were low-level gains in which pupils improve their concentration, learn to lose, and come to understand that improvement comes with learning. Second, there were high-level gains such as increase in intelligence, creativity, and school performance.

In a 1995 study titled *Chess in Education Research Summary* Dr. Robert Ferguson established that chess is instrumental in the enhancement of a child's critical thinking and good judgment skills. His subjects, seventh to ninth graders in Pennsylvania, yielded a 17.3% improvement in the results of academic performance, compared with only 4.56% for students participating in other forms of "enrichment activities."

One study, conducted by Philip Rifner, Purdue University, from 1991-1992, aimed to determine whether or not students who practiced general problem solving skills through playing chess could successfully apply those skills to an unrelated domain, in this case, poetic analysis. The study, *Playing chess: A Study of the transfer of problem-solving skills in students with average and above average intelligence*, concluded that chess proficiency develops skills which students can indeed apply to other fields. Students were shown to be more adept at poetic analysis as a result of exposure to chess, leading to the conclusion that chess potentially accelerates cognitive development in a multitude of capacities.

Learning and playing chess helps the brain as it stimulates the growth of new synaptic connections (dendrites) and improves the neural communication throughout your brain. The mental effort required to play chess can improve cognitive and communications skills. Chess is such an important brain fitnessmregimen that it deserves just as much dedication as a physical exercise routine. Chess is probably the best brain-training tool out there.

Chess helps you develop object recognition (left hemisphere which is analytical and is verbally oriented) and complex pattern recognition (right hemisphere and the source of creative ideas), which utilizes both hemispheres of the brain. Chess playing shows that both sides of the brain are active, processing information in two places simultaneously. The left hemisphere focuses on details and problem analysis. The right hemisphere is very good at solving problems by using pattern recognition and visualization to envision different scenarios.

Chess improves concentration (mental stamina and endurance) and visualization skills. In chess you are focused on one main goal, to checkmate the other player. A lack of concentration on just one move can turn a winning game into a loss.

Chess-playing groups show a significant advancement in spatial, numerical, and administrative-directional abilities, along with improved verbal skills, compared to non-playing chess groups.

From 1973 to 1974, Dr. Albert Frank, a school director based in Zaire, studied the effects of chess on children who took chess classes for two hours every week. After the lessons, he concluded that those who practiced chess demonstrated improved verbal skills, as well as enhanced mathematical skills and administrative-directional tasks. He found that good teenage chess players had strong spatial, numerical, administrative-directional, and paperwork abilities. His study was published in 1974, *Chess and Aptitudes, Doctoral Dissertation.*

Playing chess can help in preventing dementia (general term for a decline in mental ability) or Alzheimer's disease (most common type of dementia problems with memory, thinking, and behavior). There is no cure for Alzheimer's disease. In this condition, victims have short-term memory loss and tend to forget the simplest things such as their own name and even family members. Research says that people who don't exercise their gray matter stand a chance of losing brain power when they age. Chess stimulates the brain function and helps decrease the risk of Alzheimer's disease and dementia. Chess has proven to be highly effective in protecting the elderly from neuro-degenerative conditions as they get older. Dr. Robert Freidland published research, which appears in the 2001 *Proceedings of the National Academy of Sciences*, found elderly people who regularly played mentally challenging games such as chess are over 2.5 times less likely to have Alzheimer's disease.

Chess preserves mental acuity in the elderly. Chess hones an elderly player's ability to determine cause and effect patterns, analyze the relationship between two ideologies, and understand key concepts.

Chess stimulates the six cognitive areas of the brain at the same time and are the most beneficial. Those areas are: short-term memory, long-term memory, language, calculation, visual-spatial, and critical thinking.

Playing chess can lower the risk of depression and anxiety in some cases. If your depression is caused in part by having a complex life that causes worry, it's a good

idea to simplify your life. It is also recommended to take on a challenge that requires some intense focus, such as playing chess, which has a way of clearing the mind of static.

Chess may help treat schizophrenia, often characterized by abnormal social behavior and failure to recognize what is real. Chess helps through increased attention of a task, planning, and reasoning abilities. Playing chess may help some schizophrenia patients improve some their mental abilities. In a study done by Dr. Caroline Demily and other researchers in France, they found that patients in a chess group showed greater improvements in their attention, planning, and reasoning abilities than those in another group without any introduction to chess. Dr. Demily concluded, When considered together, our results suggest that playing chess for a mere 10 hours can restore (at least partially) executive functions of patients with schizophrenia. It may be interesting to note that chess can be proposed easily at almost no cost to all psychotic patients. Most of the patients kept playing chess on their own, after completion of the study.

Children love games. Chess is the kind of game that teaches a child patience and willpower. Children enjoy chess despite the fact that it is good for them. Chess improves children's thinking and problem-solving skills. A 1990-92 study in New Brunswick, Canada by Louise Gaudreau, entitled, *Etude Comparative sur les Apprentissages en Mathematiques 5e Annee (Comparative study on 5th Year Mathematics Education)*, showed the value of chess for developing problem solving skills among young children. By integrating chess into the traditional mathematics curriculum, teachers were able to raise significantly the average problem solving scores of their students. These students also scored far higher on problem solving tests than ones who just took the standard mathematics course.

Chess also improves their reading performance, math problem-solving, and science scores. Using Piaget's tests for cognitive development, kids who play chess did significantly better in their regular school testing, as well as in standardized testing, than kids who did not play chess. Chess can have a positive effect on motivation and school achievement. Former U.S. Secretary of Education Terrell Bell (1821-1996) encouraged knowledge of chess as a way to develop a preschooler's intellect and academic readiness.

A study in 1977-79 at the Chinese University in Hong Kong by Dr. Yee Wang Fung, demonstrated a significant 15% increase in test scores for mathematics for chess players, compared to students not exposed to chess education.

In 1998, James Smith and Robert Cage showed that chess was crucial in the improvement of a child's mathematical skills. In their study titled *The Effects of Chess Instruction on the Mathematics Achievement of Southern, Rural, Black Secondary Students*, they demonstrated that math proficiency test results improved in African-American high school students when they were provided 120 hours of chess instruction. James and Cage attributed the enhanced arithmetical skill of the subjects to the influence of chess on perceptual ability.

Chess in the schools shows an increased enthusiasm for learning, increase in general knowledge, increase in pupil attendance, increase in self-confidence, and increase in parent involvement. Chess teaches children to try their best to win, while accepting defeat with grace.

Chess has been shown that, when methodologically taught, it can increase the IQ in elementary age children. A 2003 study by Dr. Murray Thompson at the Flinders University in Australia showed that participants who played chess also demonstrated improved IQ levels. Thompson ascribed this to the concentration and logical thinking a chess game calls for. A similar study was conducted in Venezuela with over 4,000 children. Children who took chess classes for 4.5 months increased their IQ points. This occurred across all socio-economic groups and for both males and females.

Chess can be used by teachers to identify student learning needs. Chess also allows students and teachers to view each other in a more sympathetic way.

Chess helps children make friends more easily because it provides an easy, safe forum for gathering and discussion.

In at-risk environments, chess programs have been proven to be an effective method for helping and saving troubled youth. It can help rescue kids from gangs and drugs on the street. The incidents of suspension and outside altercations decrease dramatically when children are interested in chess. Chess can be used to channeling anger in a socially acceptable, safe and controlled environment.

Chess attracts not only gifted pupils, but students of all levels of learning and social-economic levels. Chess players usually form a pool of intellectually gifted

and talented students. Students who join this group make contact with a core of high achievers and thereby develop more academic interests and take on the values of achievement.

Dr. Hans Klaus, Dean of the School of Philosophy at Humboldt University in Berlin said, "Chess helps any human being to elaborate exact methods of thinking." It would be particularly useful to start chess from the early school days. Everybody prefers to learn something while playing rather than learn it formally. it produces in our children an improvement in their school achievements. Those children who received systematic instructions on chess improved their school efficiency in different subjects, in contrast with those who did not receive that kind of instruction.

Chess has proven its ability to calm aggressive children. The need to sit still in one place and concentrate on the board has brought a calming effect on a number of children. This has allowed them to grow into calmer individuals.

Research has shown that children with learning disabilities and Attention-Deficit Hyperactivity Disorder (ADD or ADHD) are often helped by regularly playing chess.

Chess-in-the-Schools is a nonprofit educational organization dedicated to improving academic performance and building self-esteem among inner-city public school children. Students who learn chess through their curriculum are using chess skills to achieve academic success, are more likely to attend school on a regular basis, are more likely to solve conflicts using peaceful means, and are creating lasting friendship during chess tournaments and after-school clubs.

Russia dominated the chess world for many years and more chess champions and grandmasters that any other country. The Soviet Union, after a considerable amount of educational research in elementary schools, found that experimental groups of children who learn chess in a formal, systematized way in school perform better in math and science than aged-matched control groups. Chess has been taught in Russia in Pioneer Clubs and elementary schools for over 60 years.

Chess as a deductive system has been used effectively in the classroom for introducing the study of formal Euclidean geometry.

Chess builds self-confidence and self-esteem. Playing an analyzing a chess game increased the level of mental strength and self-confidence beyond the chessboard.

It has been shown that a year of exposure to chess can dramatically improve one's self-images.

Chess can be introduced to emotionally and educationally disadvantaged people and be used as a way to learn and practice self-control.

Chess helps with rehabilitation and therapy. Chess can be used as a form of therapy for those with autism or other development disabilities. Playing chess can stimulate concentration and calm, helping to relax patients who are going through different degrees of anxiety.

Chess-playing experimental groups consistently outperformed control groups engaged in other thinking development programs, using measurements from the Watson-Glaser Critical Thinking Appraisal (WCTA - in use since 1925) and the Torrance Tests for Creative Thinking. The WCTA tests measured inference, recognition of assumptions, deduction, interpretation, and evaluation of arguments. The Torrance tests measured fluency, flexibility, and originality.

Creativity is a major aspect of chess at the master level. Chess also influences creativity at the amateur level. Chess has been show to enhance creativity in gifted adolescents. The claim that creativity can be taught through the art of chess has been confirmed.

Chess improves memory, verbal reasoning, better organizational skills, and increase in fantasy and imagination. Chess encourages you to be inventive. There is almost an infinite way of playing chess and constructing beautiful combinations and tactics.

Chess teaches independence. Playing chess helps players think for themselves. You are forced to make important decisions influenced only by your own judgment and imagination.

Chess is good for competition. Competition fosters interest, promotes mental alertness, and challenges the players. Chess tests your sportsmanship in a competitive environment. Chess, through competition, gives kids a chance to show his/her accomplishments through trophies and medals.

Chess motivates players to become willing problem solvers immersed in logical thinking for long periods of time. Chess helps in nurturing a longer attention span.

Chess can be used to develop higher order thinking skills, discipline, and creative resolution methods. It is possible that learning a difficult game like chess develops mental discipline, although that theory is not widely accepted.

Dr. David Leo Stefurak, a cognitive neuropsychologist and chess master, stated that chess instruction informs the mind and the emotions in such a way as to structure an emergent mental circuit where motivation and ability multiply to produce achievement in chess and school and life.

Chess boosts emotional intelligence, also known as EI. EI is defined as the person's ability to perceive, control, and evaluate emotions. Chess helps bring more and more people together regardless of race or socioeconomic background.

Chess helps in the ability for people to socialize, either at a chess club, chess tournament, or even on the Internet. Chess enhances your ability to interact with other people. In 1988, Joyce Brown, an assistant principal and supervisor of the school's Special Education department in New York, and teacher Florence Mirin began studying the effect of chess on their Special Education students. When the study began, they had 15 children enrolled in chess classes; two years later they had 398. The effects have been remarkable, Brown says. Not only have the reading and math skills of these children soared, their ability to socialize has increased substantially, too. Our studies have shown that incidents of suspension and outside altercations have decreased by at least 60% since these children became interested in chess.

A 1997 study, titled *Chess and Standard Test Scores*, in Texas showed that elementary students who participated in a school chess club showed twice the improvement of non-chess players in Reading and Mathematics between third and fifth grades on the Texas Assessment of Academic Skills (TAAS). The study was conducted in four of the elementary schools in a large suburban school district near Houston, Texas.

Chess is a game for people of all ages and all cultures. It is played virtually everywhere in the world, and even in space. You can learn to play chess at any age and you can play chess your entire lifetime. Age is not a factor in chess. Chess is a universal language and you can communicate with anyone anywhere in the world if they play chess. Online chess makes chess a global game. I have

played people from over 100 countries and all 50 states playing chess on the Internet.

Chess is effective because it is self-motivating. Chess encourages the search for the best move, the best plan, the best defense. The game in intrinsically fascinating, and the goals of attack and defense, climaxing in checkmate, motivate people to delve deep into their mental resources.

Chess shows that success rewards hard work, concentration, and commitment. No one is born with chess skill. Chess is an acquired skill, not an innate one. Chess teaches impatient kids the value of hard work and delayed gratification. World champion Magnus Carlsen has been working hard at chess since he was a little boy. He has been able to memorize 10,000 games and relies on his hard work and long-term memory to be successful. The more you practice, the better you become. As 6-time U.S. chess champion Walter Browne used to say, "When you win, you earn; when you lose you learn."

Chess is a test of patience, nerves, will power, and concentration.

Chess can be played at any speed, from 1-minute bullet chess, to 5-min blitz chess, to 30 minute rapid chess, to slower time control chess of a couple of hours per game, to slow correspondence chess (mail or Internet) that can take up to 14 days to move. You can find the rate of chess that is fun for you, either fast chess or slow chess. Slower play means longer analysis time and a deeper level of analysis. Faster play develops intuitions and a global perspective.

Chess helps patients who suffered from stroke, brain injuries, and other disabilities to recover. It helped me recover from a diabetes attack that put me in intensive care for four days last year. Chess has been used to assist persons suffering from physical and emotional disability to recover completely. Chess is beneficial for keeping the brain strong and can help rebuild a brain that has been damaged. As one plays chess, new neural pathways are formed replacing those that had been lost or damaged. Existing pathways are strengthened. Concentration is improved for some and stroke victims can work to regain their motor skills.

Chess develops fine motor skills as chess pieces get moved in different directions (forward, backward, diagonally forward motion, diagonally backward motion).

Chess leads to the improvement in cognitive functioning and improves the ability of cognitive-impaired individuals to work on issues related to orientation, sensory stimulation, and environmental awareness.

According to the American Therapeutic Recreation Association, for those suffering from injuries such as spinal cord damage, chess as a recreation improves the ability to enjoy life, make social contacts, and quality to overcome or suppress depression. This leads to decreased loneliness, increased social interactions, improved morale, and the ability to manage stress efficiently. Chess playing can possible reduce stress.

Chess relieves boredom and playing chess never gets boring. As a former aircraft crew chief and crewmember in the U.S. Air Force in the early 1970s, I used to fly long, boring, multi-hour missions in KC-135Q tanker aircraft. I always took a pocket chess set with me and played chess with other crew members or studied chess openings, problems, or endgames. And I was able to play chess in any USO around the world when we had several hours or a day of ground time and was never bored if I had a chess set or chess book. A chess game is almost always different. It is highly unlikely that players will see the same game twice. Different players have different styles and approaches, which adds to the variety of the game and helps keep it fresh.

Chess improves reading and writing skills. Getting better at chess involves reading chess books and magazines. The more one studies, the more one get better. Analyzing and annotating chess games help improve writing skills. Chess helps in developing general intelligence, self-control, analytic skill, and increased ability to concentrate. Enhanced reading skills naturally follow. Chess players also develop enhanced ego strength as they increase their chess competence. Chess players who feel confident and good about themselves naturally learn to read and write better. Both chess and reading are decision-making activities and some transfer of training from one to the other may be expected.

Chess is one of three fields where experience is not needed to be a prodigy. The other two fields are mathematics and music. Children can become chess prodigies because native gifts of the mind are the dominant factor. Aesthetic sensitiveness and the ability to think logically are certain inborn qualities. Abstract reasoning, a generally accepted quality inherent in both mathematics and music, is of prime importance in chess.

Chess games can be some of the greatest works of art. The best chess games by the masters are real works of art. They are the products of original and creative thinking. The beauty of chess is as compelling and pleasure giving as any other art form. Like Siegbert Tarrasch once wrote, "Chess, like love, like music, has the power to make men happy."

Chess limits the element of luck and teaches the importance of planning.

Chess requires that reason be coordinated with instinct (intuition); it is an effective decision teaching activity.

Chess is an endless source of satisfaction; the better one plays, the more rewarding it becomes. And all the top chess players in the world, such as Magnus Carlsen, Vishy Anand, Anatoly Karpov, Garry Kasparov, are all multi-millionaires from playing chess.

Chess can be a lifelong source of interest, amusement, and satisfaction. You don't need to be a good player. You can be a chess historian, chess composer, chess blogger, chess collector, etc.

Chess provides more long-term benefits than any other game or sport. Chess has the advantage of being an art, a science, and a sport. Chess expands the communication spectrum between human beings. It allows humans to interact in a positive, life affirming and self-enriching way.

Chess allows girls to compete with boys on a non-threatening, socially acceptable plane.

Chess in all its variations has been used historically to illustrated battlefield tactics and probe new strategies. Chess is taught in some military academies, such as in Sweden and Australia. Chess resembles real war in many respects. Chess is used for developing, testing, and evaluating operational concepts and strategies. Using the same mathematical techniques for creating chess-playing computers, software engineers are creating improved computer-based war games for use in military training.

Chess is pro-education, pro-family, and pro-social. Chess is a reduced and simplified model of life. It has its basic elements of time, space, and material.

Chess therapy has been used to prevent drug and alcohol abuse according to Nathan Leibowicz, the Executive Director of the National Council on Alcoholism

and Drug Dependence in New York. He developed the ChessChild program and in his opinion, a child who can control impulse decision making and delay gratification and who can resist peer pressure can say no to drugs. This form of chess therapy was also successfully employed to help people suffering from Asperger's Syndrome (difficulties in social interaction and nonverbal communication) or even correct hostile impulses in aggressive youths.

Chess therapy has also shown good results for autistic children as well. It increased their ability to concentrate, focus and channel their energy in a positive direction.

Chess has been beneficial when taught and played in prisons. Chess provides self-confidence and gives inmates the ability to solve problems they thought were impossible to solve. They begin to find solutions for situations previously regarded as hopeless.

According to the American Psychological Association, chess has been used in hundreds of psychotherapeutic approaches. In cognitive behavioral psychotherapy, the therapist observes the way the patient perceives the chess game in order to identify the source of the negative emotions and dysfunctional behaviors.

Chess has advanced artificial intelligence (AI) and computer design. Prior to 1997, the world chess champion could beat any chess computer. In May 1997, an updated version of Deep Blue defeated world champion Garry Kasparov, 3.5-2.5. Now, there are no human beings that can beat the top dozen or so chess engines. In the 1970s, British research and pioneer in AI, Donald Michie, was fond of saying that chess was the Drosophila Melanogaster (fruit fly) of Artificial Intelligence.

In 2015, healthfitnessrevolution published the top 10 health benefits of chess. Here is there list of the top 10 health benefits of chess:

- It promotes brain growth
- It exercises both sides of the brain
- It raises your IQ
- It helps prevent Alzheimer's

- It sparks your creativity
- It increases problem-solving skills
- It teaches planning and foresight
- It improves reading skills
- It optimizes memory improvement
- It improves recovery from stroke or disability

Chess can bring all kinds of recognition. In 1983, Bob Cotter took his team of inner-city kids in Indianapolis to the nationals. After the team won the championship, the kids were invited to the White House and met President Reagan.

References:

Abad, Kazemi, & Yektayer, Investigation: the Impact of Chess Play on Developing Meta-Cognitive Ability and Math Problem-Solving Power of Students at Different Levels of Education, *Procedia-Social and Behavioral Sciences*, vol 32, 2012, pp. 372-379.

Aciego, Betancort, and Garcia, The Benefits of Chess for the Intellectual and Social-Emotional Enrichment in Schoolchildren, *The Spanish Journal of Psychology*, 15(2), 2012, pp. 551-559

Artise, *Chess and Education*, 1973

Barrett and Fish, Our Move: Using Chess to Improve Math Achievement for Students Who Receive Special Education Services, *International Journal of Special Education*, 23(3), 2011, pp. 181-193

Bart & Hong, Cognitive Effects of Chess Instruction on Students at Risk for Academic Failure, *International Journal of Special Education*, vol 22(3), 2007, pp. 89-96.

Cage & Simon, *The Effects of Chess Instruction on the Mathematics Achievement of Southern, Rural, Black Secondary Students*, 2000

Celone, *Why Chess*

Chessity, *The Benefits of Chess*

Chicago Chess Foundation, *A Parent's View on Chess Benefits*, 2015

Dauvergne, *The Case for Chess as a Tool to Develop Our Children's Minds*, 2000
DuCette, *An Evaluation of the Chess Challenge Program of After School Activities Partnerships*, 2009
Ferguson, *Chess in Education Research Summary*, 2008
Frank, Zaire Chess and Aptitudes
Frydman & Lynn, The General Intelligence and Spatial Abilities of Gifted Young Belgian Chess Players, *British Journal of Psychology*, vol 83, 1992, pp. 233-235.
Garcia, Checkmate to Alzheimer's
Hall, *Why Chess in the Schools*, 1983
Horgan, Children and Chess Expertise: the Role of Calibration, *Psychological Research*, vol 54, 1992, pp. 44-50.
Howard, *Chess: Improving Academic Performance*
Ippolito, *Benefits of Chess for Children*, 2006
James, *Chess, Piaget and Polgar*, 2003
James, Chess Thinking Skills in Children, 2003
James, *Fourteen Fallacies About Junior Chess*, 2012
James, *Primary School Chess Since 1975: An Overview*, 1998
Nicotera & Stuit, , *Literature Review Gives Base to Claim of Chess Educational Benefits,* 2014
Johanna, Sophia, & Zyl, *The Significance of Playing Chess in Improving a Chile's Intellectual Actualisation*, Dissertation from Univesity of Pretoria, 1991
Kasparov Chess Foundation Europe, *The Benefits of Chess in Education*
Kitsis, *Benefits of Chess for Academic Performance and Creative Thinking*
Lelliinger, *Summary and Evaluation of the Outcomes of the German School Chess Foundation*
Liptrap, James, Chess and Standard Test Scores, 1997
Margulies, *The Effect of Chess on Reading Scores; District Nine Chess Program; Second Year Report*, 1992, The American Chess Foundation
McDonald, Patrick, The Benefits of Chess in Education
Milat, *The Role of Chess in Modern Education*, 1997
OnlineCollegesCourses, *10 Big Brain Benefits of Playing Chess*, 2012
Palm, *Chess Improves Academic Performance*, 1990
Pearson, *The Effects of Learning to Play Chess on the Nonverbal Reasoning Abilities of Grade 5 Students*, Dissertation from Nipissing University, 2009
Polgar, *the Benefits of Chess*
Princester, *10 Big Brain Benefits of Playing Chess*, 2014
Reiner, *Playing Smart: The Benefits of Chess for Kids*

Rifner , *Playing chess: A Study of the transfer of problem-solving skills in students with average and above average intelligence*
Ryan, *Chess in Education*
Sallon, Susan, *Impact of Chess on Primary School Children*, Dissertation
Sundberg, *Why We Should Teach Children Chess in Schools*, 2006
Thompson, Does the Playing of Chess Lead to Improved Scholastic Achievement?, *Issues in Educational Research*, vol 13, 2003.
Thornhill, *Chess Can Improve Children's Lives*, 2015
Trinchero, *Can Chess Training Improve Pisa Scores in Mathematics?*
USCF, *Chess Research Bibliography*
Wall, *Valedictorians and Chess*, 2015
Weinhouse, The Brainy Benefits of Chess parents.com blog
Wojcio, *The Importance of Chess in the Classroom*, 1990